What is claimed is:

1. A 4-state bar code printing system comprising:

a bar code information acquiring section for acquiring or inputting a mail piece sorting information such as a personal identification information, an article information, a sent date, a zip code, and a delivery order code, and storing and determining the acquired or inputted mail piece sorting information;

an information recorded density enhancing section for evaluating a value of a character to produce values of bars, by using of a compression method depending upon a type of the information and digit, which are determined by the bar code information acquiring section;

an input information encoding section for arranging the values of the bars produced by the information recorded density enhancing section in order of values of bars of the 4-state bar code, dividing the values of the bars into groups as a unit of three bars in order of the inputted information, and if the values is not divided into groups as a unit of three bars, adding the number of insufficient bars to the values, to allow the values of the bars to be a multiple of 3;

an error correcting codeword producing section for producing an error correcting codeword by use of an Exclusive-OR bit operation method, based on the result of the information encoding section the input value of an error

correcting level, of which a coefficient value of a index function is standardized; and

a print frame producing section for arranging the error correcting codeword produced from the error correcting codeword producing section and the data produced from the information recorded density improving section in order of a start bar, a data, an error correcting codeword, and a stop bar, to print a 4-state bar code print font on a mail piece.

2. The system as claimed in claim 1, wherein the information recorded density enhancing section divides the inputted or acquired information into a numeric character, an alphabetic character, and a Korean alphabetic character, employs a modulo 64 operation method in case of the numeric character, a modulo 27 operation method in case of the alphabetic character, or a modulo 50 and 256 operation method in case of the Korean alphabetic character, by applying a proper rule, based on a value of a 4-state bar code reference table and a digit, thereby enhancing an information recorded density.

3. A 4-state bar code printing system comprising:

means for acquiring an image of a bar code from a mail piece;

image transforming means for transforming the acquired image into a binary image information, and transferring a

coordinate information for interpreting a bar code image to image feature value acquiring means;

the image feature value acquiring means for acquiring a directional coordinate value for calculating a slope value of the bar code, and a coordinate value associated with a bar code region by a feature value of the bar code, based on the coordinate information produced from the image feature value;

bar code region extracting means for evaluating a first slope value based on the binary image information obtained by the image transforming means and the slope value of the bar code obtained by the image feature value acquiring means, and determining a searching region of a tracker bar code based on the production of a correct final slope value by tracking a location of a tracker bar;

information sorting means for extracting a uniform region by calculating a distribution of thickness of the bars and space values, among the information on the feature value of the bar determined by the bar code region extracting means, or extracting the feature value of the bar by calculating a weight value based on a variation of the thickness of the bar and the space value acquired when tracking the tracker bar, and storing the coordinate value for reading the bar code;

bar region discriminating means for examining a start bar and a stop bar based on the coordinate value obtained by the bar feature value extracting means, producing a center axis on an upper and lower end of the tracker bar by applying

a predetermined slope angle, if the bar is sloped, and producing a bar location information by evaluating the coordinate value for extracting the value of the bar;

erasure error detecting means for calculating number of location of erased bar based on the result obtained by the bar feature value extracting information sorting means, and identifying existence of an erased error;

substitution error detecting means for 1) extracting the value of the bar by use of only a coordinate value of a space, except for the coordinate region of a white bar, when extracting the value of the bar, based upon the values extracted by the bar region discriminating means, 2) after sorting a numeric, alphabetic, and Korean alphabetic letter applied region, determining whether the value of the bar is deviated from a symbol feature value, and 3) if the error exists, detecting the number and position of the error;

an error correcting codeword comparing section for, if a service pattern value corresponding to the value of the bar produced by the bar region discriminating means exists, comparing a length of the bar with that of the bar of the corresponding service pattern, determining whether the value of the service pattern does not exist and only mail piece automatic sorting code exists, and if the length of the bar coincides with that of the bar of the corresponding service pattern, classifying the bar into a data region and an error correcting codeword region, and after encoding the bar as a

data value, determining whether the produced value coincides with the read error correcting codeword; and

information frame codeword interpreting means for, if at the error correcting codeword comparing means the produced value coincides with the read error correcting codeword, interpreting the data information to perform an automatic sorting process of the mail piece, and storing the read result to be accessed.

4. The system as claimed in claim 3, wherein the image acquiring means comprises a CCD camera, a CCD scanner, and a CMOS-CCD.

5. The system as claimed in claim 3, further comprising a color image processing section for, prior to performing the binary coding process, if the acquired image is a color image, transforming the image to further obtain information of black and white pattern by use of a color signal.

6. The system as claimed in any one of claims 3 to 5, further comprising:

error correcting range comparing means for, if an error is detected by the erasure error detecting means or the substitution error detecting means, comparing a position and number information of an erasure error and a number information of a substitution error with the error correcting

range, to determine whether the error correction is possible; and

error correcting means for, if the correct is impossible, producing an unreadable message to divide it into a sorting reject and store the read result, and if the correction is possible, performing the error correction.

7. A method for printing 4-state bar code, comprising the steps of:

1) acquiring a mail piece sorting information from a mail piece, and storing and determining the mail piece sorting information;

2) evaluating a value of a character to produce values of bars, by use of a compression method depending upon a type of the information and digit;

3) arranging the values of the bars produced by the step 2 in order of values of bars of the 4-state bar code, dividing the values of the bars into groups as a unit of three bars in order of the inputted information, and if the values is not divided into groups as a unit of three bars, adding the number of insufficient bars to the group, to allow the values of the bars to be a multiple of 3;

4) producing an error correcting codeword by use of an Exclusive-OR bit operation method, based on the result of the step 3, of which a coefficient value of a index function is standardized; and

5) arranging the error correcting codeword produced from the step 4 and the data produced from the step 2 in order of a start bar, a data, an error correcting codeword, and a stop bar, to print a 4-state bar code print font on a mail piece.

8. The method as claimed in claim 7, wherein the step for compressing a numeric information, the step comprising the steps of:

a) substituting a numeric information into a decimal number b) dividing the substituted value by 64^3;

c) setting an integer of the result obtained from the step item b to a compressed data value 1;

d) evaluating a difference between the value of the step c and the value of the step b, and dividing the difference by 64^2; and

f) applying values obtained by repeating the same procedures as those of step c and d using 64^1 and 64^0.

9. The method as claimed in claim 7, wherein the step for compressing an alphabetic information, the step comprising the steps of:

a') reading an alphabetic character to know the number of characters and an alphabetical order of each character;

b') substituting the alphabetic information into decimal number using a formula $V_n=b_n27^n + \ldots + b_327^3 + b_227^2 + b_127^1 + b_027^0$, wherein n is a positive integer corresponding to the

number of characters, and b is a positive integer corresponding to the alphabetic order of each character;

c') setting 1st and 2nd digits value to a first bar code character value by use of a 16 modulo method based on a maximum value, at the value V_n obtained from the step b';

d') dividing the value V_n obtained from the step b' into groups consisting of 3-digits, except for the 1st and 2nd digits, and evaluating a value of a quotient calculated by a 64 modulo method; and

e') evaluating a value of the bar code by arranging values obtained from the steps c' and d' in order.

10. The method as claimed in claim 7, wherein the step for compressing a Korean alphabetic information, the step comprising the steps of:

a") knowing a Korean Alphabet completion character to obtain the number of characters and alphabetical order;

b") substituting the character information into decimal number based on the information and a value of bar code character obtained in step a";

c") dividing a value of 1st to 4th digits from the decimal numbers obtained from the step b" by 256^2, to obtain an integer value of the result;

d") multiplying a difference between the actual value and the integer value obtained from the step c" by 256;

e") dividing the result obtained from the step d" by 256,

and repeating the steps c" and d";

f") dividing the remaining digits obtained from the step b" by 256, and evaluating a value by repeating the steps c" and d"; and

g) evaluating a value of bar code by arranging the values obtained from the step f" in order of 4-state 6 bar.

11. The method as claimed in any one of claims 8 to 10, wherein the step of producing the error correcting codeword is performed by a following equation, and

$$g(x) = (1+x)(1+x^2)(1+x^3)(1+x^4) = x^4 + \alpha^{19}x^3 + \alpha^{41}x^2 + \alpha^{24}x + \alpha^{10}$$

the step comprises the steps of:

producing a hexadecimal binary table associated with values of GF(64) and a reference table in which hexadecimal values are arranged by coefficient values of index α, storing the tables to a memory, and performing an hexadecimal Exclusive-OR operation by use of following tables 1 and 2 to produce an error correcting codeword.

Table 1

Index	16 Bit	HEX	EXP
0	(000000)	0x00	NULL
1	(100000)	0x20	α^0
2	(010000)	0x10	α
3	(001000)	0x08	α^2
4	(000100)	0x04	α^3

⋮	⋮	⋮	⋮
60	(101111)	0x2f	α^{59}
61	(100111)	0x27	α^{60}
62	(100011)	0x23	α^{61}
63	(100001)	0x21	α^{62}

Table 2

Bit	HEX	BTI	EXP	Index
(000000)	0x00	0	-1	-1
(000001)	0x01	1	α^{5}	5
(000010)	0x02	2	α^{4}	4
(000011)	0x03	3	α^{10}	10
⋮	⋮	⋮	⋮	⋮
(111100)	0x3c	60	α^{18}	18
(111101)	0x3d	61	α^{40}	40
(111110)	0x3e	62	α^{56}	56
(111111)	0x3f	63	α^{58}	58

12. A method for reading a 4-state bar code, the method comprising the steps of:

1) acquiring an image of a bar code from a mail piece;

2) transforming the acquired image into a binary image information, and evaluating coordinate values for a minimum value and a maximum value based on a horizontal line of the mail piece;

3) acquiring a directional coordinate value for

calculating a slope value of the bar code, and a coordinate value for a bar code region by a feature value of the bar code, based on the coordinate information produced from the step 2;

4) determining an examining region of a tracker bar code based on the binary image information and the slope value of the bar code, each obtained by the steps 2 and 3;

5) extracting a uniform region by calculating a distribution of thickness of the bar and a space value, among the information on the feature value of the bar, and storing the coordinate value for reading the bar code;

6) examining a start bar and a stop bar based on the coordinate value obtained from the step 5, producing a center axis on an upper and lower end of the tracker bar by applying a predetermined slope angle, if the bar is sloped, and producing a bar location information by evaluating the coordinate value for extracting the value of the bar;

7) calculating number of location of erased bar based on the result obtained from the step 6, and identifying existence of an erased error;

8) extracting the value of the bar by use of only a coordinate value of a space except for a coordinate region of a white bar, when extracting the value of the bar, based upon the values extracted from the step 6, after sorting the numeric, alphabetic, and Korean alphabetic letter applied region, determining whether the value of the bar is deviated from a symbol feature value, and if the error exists,

detecting the number and position of the error;

9) if a service pattern value corresponding to the value of the bar produced from the step 6 exists, comparing a length of the bar with that of the bar of the corresponding service pattern, determining whether the value of the service pattern does not exist and only mail piece automatic sorting code exists, and if the length of the bar coincides with that of the bar of the corresponding service pattern, classifying the bar into a data region and an error correcting codeword region, and after encoding the bar as a data value, determining whether the produced value coincides with the read error correcting codeword; and

10) if the produced value coincides with the read error correcting codeword at the error correcting codeword comparing means, interpreting the data information to perform an automatic sorting process of the mail piece, and storing the read result to be accessed.

13. The method as claimed in claim 12, further comprising the steps of:

11) setting an image region of a postal address and a bar code region, before the image is obtained from the mail piece, dividing the image region into two equal upper and lower parts, and examining the image region from the upper to the lower or from the lower to the upper;

12) if a black pixel is found on a horizontal line in

course of searching the image on the mail piece, evaluating a difference between a length of the bar and a length of a horizontal line to predict a sloped direction of the bar code based on the found location value, and comparing a thickness of the bar and a space value to identify the bar code; and

13) comparing a bar code region, which is found when examining the image of the postal address, with coordinate values for the start and stop bars.

14. The method as claimed in claim 13, further comprising the steps of:

14) in course of searching the horizontal line based on the black pixel, storing minimum and maximum values of the coordinate values of the horizontal line, and determining whether the maximum and minimum values are increased or decreased by comparing them with previous data;

15) if the sloped direction of the bar is determined from the step 14, selecting one among the maximum and minimum values to sort the coordinate values depending upon the increasing or decreasing state of the value; and

16) calculating a sloped angle based on the coordinate value (x, y) for a range of the sorted coordinate values, and evaluating an average value of the sloped angle value to obtain a slope angle value.

15. The method as claimed in claim 14, further comprising

the steps of:

17) storing the obtained image to a temporary memory;

18) producing two center axes on an upper end and a lower end of a tracker bar through the slope value of the coordinate values of the start and stop bars in the 4-state bar code range based on the image stored in the temporary memory and the evaluated coordinate value and slope value;

19) checking a range with uniform thickness of the bar and uniform space value to calculate an average thickness of the bar and an average space value, or in case that the thickness of the bar and the space value are varied, extracting the tracker bar to produce a weight value for a corresponding coordinate by use of a distribution value of the varied value, and in case that the bar is erased, evaluating the number of the erased bar and the space value based on a final slope angle produced by tracking the tracker bar;

20) setting a coordinate by use of a slope of the coordinate value with the bar positioned, an average thickness of the bar, and an average space value based on the two center axes, searching the coordinate up and down to produce a value for calculating a value of the bar;

21) if the black pixel does not exist at a position of the coordinate value in the step 20, determining whether a pixel value of the black pixel exists by dividing the center axis of the coordinate value into two equal parts, and if the black pixel does not exist, determining the bar is erased and

producing a location value of the bar; and

22) calculating the location value of the erased bar obtained from the step 21, and storing the location value of the erased bar as '4' to identify that the bar corresponding to the location is error in course of error correction.

16. The method as claimed in claim 12, further comprising the steps of:

23) identifying the number of the bar detected as an error and the number of symbologies; and

24) if the number of the bar detected as an error is below 13 and five symbologies are detected as an error in the step 23, setting a symbology as an error, of which two bars are error, by searching one symbology of which one bar is error and the other symbology of which two bars are error, and after a value of the symbology, of which one bar is error, by substituting 0, 1, 2 and 3 for the location value of the error, calculating a value of the symbology for each error bar to perform the error correction.

17. The method as claimed in any one of claims 12 to 16, further comprising the steps of:

25) if a process of reading the bar code is normally executed, interpreting a content of compressed information based on the information of a recorded data region, to automatically sort the mail pieces and simultaneously storing

the corresponding information;

26) initializing a binary image of the temporary memory used when reading the mail piece, a coordinate data, and a temporary data stored for correcting the error; and

27) if there are a plurality of 4-state bar codes, dividing equally the temporary memory region into parts corresponding to the number of the 4-state bar codes, to read all of the 4-state bar codes.